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ABSTRACT

A study was conducted to analyze and compare the job performance of civil service and military pavements maintenance workers and construction equipment operators. A military sample of 2,675 and a civilian sample of 1,974 were surveyed by means of a job inventory checklist and relative time spent rating method. Of the three job types that were identified (grounds maintenance, equipment operators, and pavements workers), military grounds workers expressed the lowest job interest and job utilization of training and skills. No significant difference was found between civilian and military members in number of tasks performed for the total sample; however, average task difficulty and job difficulty appeared higher for the military. A major difference was discovered in length of time on the job with military members reporting considerably less time because of their transitory status. Generally, civilian workers indicated higher job interest and job utilization than did military personnel. To determine if the improved utilization of equipment was an effective means of increasing job interest for military members, a comparison was made between military data collected in 1969 and the current data, and an increase in job interest was indicated as a result of greater equipment use. (ELG)

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COMPARATIVE OCCUPATIONAL SURVEY OF CIVILIAN AND MILITARY MEMBERS IN THE PAVEMENTS MAINTENANCE AND CONSTRUCTION EQUIPMENT OPERATOR SPECIALTIES

By

Douglas K. Cowan

OCCUPATION AND MANPOWER RESEARCH DIVISION
Brooks Air Force Base, Texas 78235

December 1977
Final Report for Period 1 October 1975 – 31 October 1977

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Military and civil service pavements maintenance workers and construction equipment operators were surveyed using a job inventory checklist and relative time spent rating method along with background item responses. Job clustering and job typing of combined responses were performed and comparisons made between civilian and military groups as well as comparisons between the two groups on several background variables. No significant difference was found between civilian and military members in number of tasks performed for the total sample. However, at the specialty level some significant differences did occur. Average task difficulty and job difficulty means were higher for military members than for civil service members in some skill levels. Generally, the civilian members indicated higher job interest and felt job utilization of training and talents than did the military members.

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Military data collected in 1969 were compared to current data. An increase in felt utilization of training and talents was found as well as increased equipment utilization for first-term airmen.

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COMPARATIVE OCCUPATIONAL SURVEY OF CIVILIAN AND MILITARY MEMBERS IN THE PAVEMENTS MAINTENANCE AND CONSTRUCTION EQUIPMENT OPERATOR SPECIALTIES

I. INTRODUCTION

Job information collected from military members, using methodologies prescribed by AFM 35-2,[1] has proven to be highly accurate. The impact of the occupational analysis program on military training emphasis throughout the Air Force has been substantial, resulting in millions of dollars of documented training cost avoidance. In addition, career fields have been restructured and Air Force specialty descriptions have been revised to be more indicative of actual job performance.

Within the civilian employee area, an initial effort by Garza (1972) in collecting and analyzing data from General Schedule employees in the Accounting and Finance field proved successful, indicating that participation in job surveys by civilian federal employees is feasible. The successful job analyses performed by Garza (1972) and a request by HQ USAF/PREM (Civil Engineering) to include civilians in future occupational surveys formed the basis for this study. Since it is the desire of the Directorate of Civil Engineering to attempt to define upgrade training requirements, and to understand civilian utilization patterns in conjunction with military personnel, the best approach is to include civilians in joint civilian/military job inventories.

Civil Engineering organizations are structured in a manner that provides a force that is approximately 50% civilian. However, it was not known if civilian and military members perform nearly identical duties and tasks. AFM 26-1, Manpower Policies and Procedures, provides only limited guidance in the use of civilian employees within Air Force specialties (AFS) and specifies that the Air Force specialty codes (AFSC) are intended as broad indicators of civilian skills and skill levels required. There is a small amount of empirical evidence (Stacy, 1973) that differences in job assignment or level of responsibility do exist between military and civilian members in the Pavements Maintenance and Construction Equipment Operator career ladders, as indicated by reports from the field and felt utilization of training and talents as reported by incumbents. The goal of this study was to identify any significant differences between the two groups in functional areas of assignment, duties and responsibilities, utilization of equipment, and expressed job satisfaction as measured by reported job interest and job utilization. Other variables in which differences were expected are the number of tasks performed, average task difficulty, job difficulty, and job tenure. Garza and Carpenter (1974) reported significant differences between military and General Schedule Civil Service employees with respect to such variables. These variables were treated in difference comparisons between the civilian employees within the four civil service classifications (General Schedule, Wage Supervisor, Wage Leader, and Wage Grade) and their military counterparts in the Pavements Maintenance and Construction Equipment Operator career ladders.

In addition, limited comparative analysis was performed between military data collected in 1969 and the present data.

II. METHOD

Development of the Job Inventories

Military Version. Air Force job inventories were developed by the USAF Occupational Measurement Center, Lackland AFB, Texas. Each inventory was composed of two parts, one containing a personal information section in which job incumbents provide information about themselves, and another, a duty-task listing which requires that the incumbent rate each task he performs using a relative time spent scale. In this specific case, the duty-task listing consisted of 26 major duties (encompassing 927 task statements) constructed from data gained from research of publications and directives, personal interviews with subject-matter specialists, and written field reviews from 100 experienced military Pavements Maintenance and Construction Equipment Operators. Comments and suggestions for improvement of the job inventory, received from the written review, were incorporated into the final version of the job inventory, if applicable.

Civilian Version. The duties and tasks developed for military incumbent use were incorporated into the civilian job inventory, along with modified background variables specific to civilians and variables that were applicable to both civilian and military personnel. The background variables

[1] AFM 35-2 was revised and reissued as AFR 35-2, 6 December 1976.

ere reviewed by 11 civilian craftsmen at three local Air Force bases for content, format, and acceptability of the questions to the individuals. Twenty geographically selected bases across the United States were chosen to solicit civilian Pavements Maintenance and Construction Equipment employees to participate in a field review of the job inventory. Completed field reviews were received from 18 bases encompassing seven major commands. Twenty-three additional task statements, as well as eleven special experience statements or items of equipment, were identified by the technical advisors which were added to the job inventory as supplemental task and equipment variables, but which were not used in the civilian/military comparisons in order to have identical task listings.

Sample Size and Selection

Military Incumbents. Completion of the job inventory by military personnel is mandatory and collection of data from the total population is usually attempted. The uniform airman record (UAR) was used to determine the number of military assigned duty as Pavements Maintenance workers (AFSCs 55130/50/70), Construction Equipment Operators (AFSCs 55131/51/71), and Pavements and Construction Equipment Superintendents (AFSC 55191). In addition, duty location and servicing consolidated base personnel office (CBPO) were identified for each incumbent. A total of 4,233 incumbents were identified as holding the required duty Air Force specialty code (DAFSC). Of the 4,233 booklets sent to the field, 25% were unusable because they were returned blank or incorrectly completed, while 12% were not returned. The number of usable booklets represents 63% of the estimated population and provides a sample of 2,675 incumbents.

Civilian Incumbents. Sample size was totally dependent upon the number of U.S. Civil Service employees who voluntarily consented to complete the job inventory. The Civilian Automated Data File (E-201) was used to determine the number of civilians assigned duty as Pavements Maintenance employees (AFSCs 55130/50/70), Construction Equipment Operators (AFSCs 55131/51/71), and Pavements and Construction Equipment Superintendents (AFSC 55191). The E-201 file is a centrally compiled file from which the number of civilian personnel assigned to each skill level of any desired AFSC by location of assignment can be derived. A total of 4,705 civilians were identified as holding the required DAFSC. However, 17 overseas bases indicated that 682 positions identified were filled with local national (foreign) workers, effectively reducing the population to 4,023 incumbents. A total of 2,205 booklets were returned from the field, of which 2,014 were found to be usable, representing a voluntary response rate of 55% of the total estimated population. Booklets were rejected primarily because of the incumbent's failure to rate tasks performed. An additional 40 booklets were discarded, due to optical scanning problems resulting in a final sample of 1,974 incumbents.

Job Inventory Administration[2]

Military Sample. Job inventory booklets were mailed to CBPOs world-wide for administration to all military members. Upon completion, the survey control officers returned the inventory booklets to the USAF Occupational Measurement Center. The personal history contained in the background information section of the booklet (as well as task response data) were scanned for obvious omissions, each booklet was assigned a unique case control number, and the data were keypunched and placed on magnetic tape.

Civilian Sample. Job inventories, in optical scan format, were mailed to the Civilian Personnel Officer at each identified location. The option of group or individual administration was left to his discretion in coordination with the base civil engineer. Incumbents reported that they completed the job inventory under the direct supervision of a civilian personnel officer representative in 1,487 out of the 1,974 cases.

Each incumbent was furnished a job inventory booklet and a brown manila envelope in which to seal the completed job inventory to protect their responses from unauthorized intrusion. Job incumbents were asked to complete the background questions, to read the inventory and to identify tasks that they perform in their present job, to add any tasks they do perform, but which were not listed, and to rate each task performed using a relative time spent scale.

The sealed envelopes were then mailed to AFHRL/ORA by the civilian personnel officer. Upon receipt, the inventories were scanned for obvious omission of task ratings, assigned a unique case control number, and optically scanned and keypunched to enable raw data responses to be placed on magnetic tape in preparation for computer operations.

[2] The Job Inventory was administered to civil service employees during July through October 1975, and to the military personnel from April through May 1974.

Merged Military-Civilian Sample

Raw data responses contained on the two magnetic tapes were merged into one sample in preparation for computer operations using the Comprehensive Occupational Data Analysis Programs (CODAP) (Archer, 1966; Morsh & Christal, 1966).

Comprehensive Occupational Data Analysis Programs (CODAP)

CODAP contains approximately 40 general purpose programs (Christal, 1974) consisting of nearly 50,000 program instructions. Basic to the first step in analysis of the job information data, the computer converts each individual's relative time spent ratings to percent time values. This is accomplished by summing all the incumbent's ratings, which are assumed to account for 100 percent of his time spent on the job. Each task rating is then divided by the total task responses and the quotient multiplied by 100 to obtain a percent time estimate for each task. For job analysis, a hierarchical grouping program (Christal & Ward, 1967) is used in which each individual is compared with every other individual in terms of percent time spent estimates for each task in the inventory. The two most similar individuals are formed into a group by the computer and in successive stages other members are added to the group or new groups are formed based upon the similarity of percent time spent on tasks. Each group formed is identified by a unique three-digit number; e.g., GRP 001 indicates the last group formed and contains all members of the sample. Other CODAP programs convert raw data background variable responses into quantified form which may then be summarized by group identity or special category, based on background variables, etc. Numerous specific reports are obtainable through use of the CODAP to assist in job analysis, such as comparisons between groups, or lists of primary tasks performed by job type (those few individuals who group together doing almost identical work and having similar background histories) or job clusters, in which the work performed by the individuals is highly homogenous, but not to the same extent of similarity as a job type.

III. RESULTS AND DISCUSSION

Major Command Representation

Slightly more than 80% of the combined civilian/military sample represents incumbents assigned to seven major commands (see Table 1).

Table 1. **Sample Distribution by Major Command**

Major Command	Sample		Civilian		Military	
	N	%	N	%	N	%
SAC	1,471	31.64	600	12.91	871	18.74
TAC	765	16.46	210	4.52	555	11.94
ATC	454	9.77	283	6.09	171	3.68
AFSC	312	6.71	177	3.81	135	2.90
MAC	307	6.60	156	3.36	151	3.25
AFLC	233	5.01	143	3.08	90	1.94
PACAF	183	3.94	29	0.62	154	3.31
AAC	179	3.85	40	0.86	139	2.99
USAFE	158	3.40	0	0.00	158	3.40
ADC	120	2.58	49	1.05	71	1.53
AFRES	105	2.26	90	1.94	15	0.32
USAFA	65	1.40	52	1.12	13	0.28
HQ COMD	53	1.14	11	0.24	42	0.90
NGB	46	0.99	46	0.99	0	0.00
AFCS	42	0.90	25	0.54	17	0.37
AU	36	0.77	22	0.47	14	0.30
USAFSS	36	0.77	6	0.13	30	0.65
USAFSO	19	0.41	0	0.00	19	0.41
HQ USAF	7	0.15	3	0.06	4	0.09
ACIC	1	0.02	1	0.02	0	0.00
AFAFC	1	0.02	0	0.00	1	0.02
Not reported	56	1.20	31	0.67	25	0.54
Totals	4,649	99.99	1,974	42.48	2,675	57.56

Three of the commands: Strategic Air Command, Tactical Air Command, and Military Airlift Command (SAC, TAC, & MAC) are operational types; three commands: Air Training Command, Air Force Logistics Command, and Air Force Systems Command (ATC, AFLC, & AFSC) are support types, while Pacific Air Forces (PACAF) is a combination support and operational command. SAC, TAC, and PACAF are more heavily represented by military incumbents than civilian members, while the reverse is true for ATC, AFSC, and AFLC. The percentages of civilian and military incumbents reported from MAC are approximately equal.

Skill Level Grouping

Military personnel (without prior military service) enter into the Pavements Maintenance and Construction Equipment Operator career ladders in primarily three ways: (a) through a technical school where, upon graduation, they are awarded the semi-skilled apprentice level and are immediately placed in on-the-job training (OJT) for upgrade to the specialist level; (b) by way of a directed duty assignment (DDA) from basic military training without benefit of a technical training school with entry into OJT to the apprentice level; and (c) by way of a by-pass test administered to the recruit at the Armed Forces examining and entrance stations (AFEES). The by-pass test is administered to those personnel who profess a knowledge of a specialty gained from civilian experience. Successful scoring on the test negates the necessity of sending the recruit to basic technical school or assigning him as a DDA for entry into OJT to the apprentice level. He completes basic military training in normal fashion and is then assigned to a permanent duty station as an apprentice and entered into the specialist OJT program. Upon attainment of the specialist AFSC, the airman is not entered into upgrade training to the technician level until he has been promoted to the grade of E-5. Normally, certain time period constraints are also in effect during the period of OJT plus the requirement to achieve a passing score on a specialty knowledge test (SKT). The Superintendent level AFSC is reserved for those senior level airmen assigned to 9-level slots on the unit detail listing (UDL) or to airmen in the grade of E-8 or E-9. Promotion to the grade of E-8 and simultaneous awarding of the 9-level AFSC is dependent upon achieving a passing score on the Supervisory Examination which is administered to E-7s to partially fulfill the eligibility requirements for promotion.

Civilian personnel are hired to fill specific vacancies and are assumed to be fully qualified for the positions for which they are hired. An exception to the fully qualified requirement is apparent for those in-service civilian employees who are selected for a trainee position that normally carries a higher grade level with promotion to the higher grade level contingent upon successfully completing a mandatory training period. Another exception, very similar to the one above, is the upward mobility program which allows members to gain higher level skills and hence higher grade levels through on-the-job training.

A civilian is not awarded a skill level as is an airman, nor is he required to demonstrate his proficiency to progress from one skill level to another in order to achieve promotion. The AFSC that is associated with the civilian is a functional part of the UDL and is assigned to a specific slot. Thus, a fully qualified civilian employee may be assigned to 3-, 5-, 7-, or even to a 9-skill level slot depending upon the strength level restraints of the unit to which he is assigned and the job series classification aligned with the position.

Even though the skill level does not carry the same meaning for civilian employees as it does for military personnel, the intent of the skill level on the detail listing is the same—to identify jobs requiring a specified level of competence. In this respect, it is permissible to compare civilian and military members by skill level groups.

Table 2 compares the civilian and military members assigned to each skill level on six job related variables. Some differences are noted between the two groups on the number of tasks performed, average task difficulty per unit of time spent, and job difficulty. However, the comparison between total sample civilian and military members shows no significant difference between the two groups on the number of tasks performed. The average task difficulty per unit of time spent, (ATDPUTS) and the average job difficulty are significantly higher for the military personnel.

The months in job differences are as would be expected between two groups when one group (military) is moved frequently as opposed to the relative non-transitory job pattern of the civilian employee.

In most skill levels and for total samples, the differences between the two groups in expressed job interest and felt utilization of training and talents are significant. In all cases, the civilian members expressed higher job interest and utilization ratings. Intercorrelation coefficients among the six variables (see Table 3) indicate that positive

Table 2. Comparison of Civilian and Military Members on Six Variables by AFSC

Specialty	Group ID	N	Number of Tasks Performed			ATDPUT			Job Difficulty		
			Mean	SD	t-test	Mean	SD	t-test	Mean	SD	t-test
Apprentice Pavements	Civ	620	59.34	56.31		4.07	0.37		8.99	4.45	
Maintenance Specialist (55130)	Mil	85	62.91	50.15	0.554	4.11	0.30	0.959	9.57	3.70	1.147
Pavements Maintenance	Civ	582	90.06	82.01		4.25	0.38		11.47	5.02	
Specialist (55150)	Mil	1,082	89.29	75.19	0.193	4.27	0.35	1.404	11.67	4.54	0.850
Pavements Maintenance	Civ	132	149.60	111.27		4.86	0.39		16.66	3.94	
Technician (55170)	Mil	183	107.02	95.67	3.638***	4.92	0.41	1.263	14.99	3.90	3.735***
Apprentice Construction	Civ	62	98.74	80.55		4.61	0.44		13.59	5.85	
Equipment Operator (55131)	Mil	147	69.16	60.44	2.916**	4.57	0.33	0.747	11.67	4.19	2.665**
Construction Equipment	Civ	437	121.91	99.09		4.72	0.38		14.72	5.78	
Operator (55151)	Mil	819	109.39	100.20	2.117*	4.74	0.30	0.774	14.42	4.46	1.011
Construction Equipment	Civ	53	154.13	122.61		5.03	0.28		16.78	4.71	
Technician (55171)	Mil	177	120.42	96.20	2.094*	5.08	0.29	1.190	16.24	4.15	0.795
Pavements and Construction	Civ	69	139.10	120.72		5.29	0.36		17.78	3.70	
Equipment Superintendent (55191)	Mil	60	96.60	87.86	2.256*	5.45	0.26	2.819**	16.43	2.29	2.445*
Total Sample	Civ	1,974	95.30	90.01		4.41	0.51		12.12	5.68	
Group 001	Mil	2,675	96.53	86.28	0.472	4.55	0.46	10.239***	13.06	4.73	6.104***

Table 2 (*Continued*)

Specialty	Group ID	N	Months in Job			Job Interest			Job Utilization of Training and Talents		
			Mean	SD	t-test	Mean	SD	t-test	Mean	SD	t-test
Apprentice Pavements Maintenance Specialist (55130)	Civ	620	46.94	64.96		5.05	1.33		3.81	1.65	
	Mil	85	19.43	13.01	3.891***	3.62	1.67	8.780***	2.57	1.54	6.538***
Pavements Maintenance Specialist (55150)	Civ	582	62.05	72.97		5.31	1.27		4.29	1.61	
	Mil	1,032	32.30	32.45	11.463***	3.86	1.74	17.862***	2.95	1.66	15.953***
Pavements Maintenance Technician (55170)	Civ	132	87.10	82.66		6.02	0.92		5.27	1.33	
	Mil	183	38.89	54.98	6.213***	5.23	1.50	5.400***	4.24	1.66	5.905***
Apprentice Construction Equipment Operator (55131)	Civ	62	84.53	94.08		5.31	1.37		4.57	1.69	
	Mil	147	12.44	11.21	9.165***	4.82	1.49	2.249*	3.46	1.44	4.841***
Construction Equipment Operator (55151)	Civ	437	98.73	94.53		5.33	1.26		4.48	1.60	
	Mil	819	29.49	29.68	19.263***	4.87	1.59	5.209***	3.58	1.62	9.615***
Construction Equipment Technician (55171)	Civ	53	112.33	90.33		5.83	1.00		5.27	1.21	
	Mil	177	70.46	43.16	9.103***	5.61	1.36	1.101	4.42	1.59	3.554***
Pavements and Construction Equipment Superintendent (55191)	Civ	69	113.42	94.23		6.19	0.73		5.59	1.26	
	Mil	60	22.00	37.04	7.053***	6.00	0.98	1.261	5.24	1.53	1.442
Total Sample Group 001	Civ	1,974	71.10	81.89		5.33	1.28		4.33	1.66	
	Mil	2,675	29.87	33.99	23.451***	4.48	1.75	18.272***	3.39	1.63	19.284***

*Significant at .05 level of confidence.
**Significant at .01 level of confidence.
***Significant at .001 level of confidence.

Table 3. Comparison of Civilian and Military Groups' Intercorrelations Among Six Variables

Variable	Variable 1	2	3	4	5
Number of tasks performed					
Civilian					
Military					
Task difficulty (ATDPUTS)					
Civilian	.39				
Military	.17***				
Job difficulty index					
Civilian	.90	.69			
Military	.75***	.53***			
Months in job					
Civilian	.17	.27	.24		
Military	.13	.00***	.10***		
Job interest					
Civilian	.17	.24	.24	.10	
Military	.21	.38***	.36***	.06	
Job utilization					
Civilian	.19	.29	.28	.19	.65
Military	.21	.37**	.34*	.05***	.69*

*Correlations significantly different at .05 level of confidence.
**Correlations significantly different at .01 level of confidence.
***Correlations significantly different at .001 level of confidence.

relationships exist between nearly all of the variables for both civilian and military members. Between civilian and military members, significant differences in correlation coefficients are found in all but four of the variable pairs.

Civilian and military composite duty descriptions were obtained for each of the three skill levels (3-, 5-, & 7-) for the two career ladders as well as for the 9-skill level which receives input from either career ladder during the course of normal military career ladder progression.

Table 4 presents the duty job descriptions based upon the percentage of civilian and military members performing each duty for the Pavements Maintenance career ladder. Table 5 shows the same information for the Construction Equipment Operator career ladder and for the Pavements and Construction Equipment Superintendent.

At the apprentice and specialist levels of the Pavements Maintenance career ladder, only three duties are strikingly different as to the percent members performing. Duties G and H are performed by a considerably higher percentage of military members, while the reverse is true for duty O. At the 7-skill level, duties are quite similar except for duties N and O where the percentage of civilian members performing is considerably higher.

Duty performance by the civilian and military members in the Construction Equipment career ladder is even more similar than for the Pavements Maintenance area. Only one duty (duty O) has a difference in percent members performing in excess of 20%.

At the superintendent level, however, for three duties, the difference between civilian and military members' performance exceeds 20%. Duties I, N, and O are all performed by a larger percentage of the civilian employees than by the military members.

The representative job descriptions for the two career ladders indicate that there is considerable overlap between the two career fields, insofar as the percentage of members performing the duties is concerned. However, when the relative time spent by the incumbents in the two areas are compared, the separation of the two specialties becomes apparent.

Table 4. Percent Members Performing in Duties by Pavements Maintenance Personnel

Duty	Title	55130		55150		55170	
		N=620 Civ	N=85 Mil	N=582 Civ	N=1,082 Mil	N=132 Civ	N=183 Mil
A	Organizing and planning	25	20	38	40	92	92
B	Directing and implementing	28	36	38	58	92	95
C	Inspecting and evaluating	9	11	17	21	81	84
D	Training	9	7	16	23	66	78
E	Working with forms, records, reports, directives, or technical data	26	25	35	47	89	94
F	Performing laboratory and field tests	3	12	10	19	40	26
G	Constructing and maintaining rigid pavements and concrete structures	31	81	51	81	45	68
H	Constructing and maintaining flexible pavements	18	65	34	74	29	59
I	Constructing and maintaining drainage systems	47	72	56	79	65	72
J	Building bunkers and revetments	17	32	24	31	22	17
K	Constructing and maintaining prefabricated surface mats	5	12	9	15	11	15
L	Working with explosives	4	0	3	3	7	4
M	Constructing and maintaining railroad trackage	14	22	20	27	20	16
N	Performing ground maintenance	94	80	93	80	89	53
O	Applying herbicides and fungicides	40	9	41	15	60	17
P	Operating trucks, front end loaders, and forklifts	58	82	73	85	55	57
Q	Operating industrial tractors and attachments	55	42	69	57	64	34
R	Operating graders	8	5	17	21	17	19
S	Operating dozers and scrapers	8	2	13	13	11	10
T	Operating specialized equipment	24	35	36	51	36	35
U	Operating cranes and attachments	5	1	12	9	11	8
V	Operating miscellaneous equipment	45	49	52	54	40	33
W	Performing snow removal functions	34	47	44	50	41	34
X	Rigging hoisting equipment	22	22	30	28	23	14
Y	Performing missile support functions	3	7	6	6	4	3
Z	Operating well drilling equipment	1	5	2	3	2	1

Table 5. **Percent Members Performing in Duties by Construction Equipment Personnel and Superintendents**

Duty	Title	55131		55151		55171		55191	
		N=62 Civ	N=147 Mil	N=837 Civ	N=819 Mil	N=53 Civ	N=177 Mil	N=69 Civ	N=60 Mil
A	Organizing and planning	19	15	26	34	72	83	90	100
B	Directing and implementing	29	25	38	52	77	92	96	98
C	Inspecting and evaluating	13	7	11	18	64	67	88	97
D	Training	21	12	28	29	60	80	77	90
E	Working with forms, records, reports, directives, or technical data	37	32	32	50	74	85	94	98
F	Performing laboratory and field tests	6	1	4	5	13	5	21	22
G	Constructing and maintaining rigid pavements and concrete structures	34	35	43	45	34	27	36	27
H	Constructing and maintaining flexible pavements	44	34	44	41	43	30	35	27
I	Constructing and maintaining drainage systems	61	51	60	61	68	63	72	47
J	Building bunkers and revetments	21	17	30	26	30	12	14	5
K	Constructing and maintaining prefabricated surface mats	10	12	13	19	23	12	10	7
L	Working with explosives	0	1	3	3	6	3	1	5
M	Constructing and maintaining railroad trackage	5	10	10	7	21	3	22	12
N	Performing ground maintenance	71	67	66	69	64	44	54	32
O	Applying herbicides and fungicides	23	2	10	5	11	3	36	13
P	Operating trucks, front end loaders, and forklifts	79	95	85	91	72	65	29	18
Q	Operating industrial tractors and attachments	66	69	70	73	62	47	25	15
R	Operating graders	42	59	63	77	64	62	25	10
S	Operating dozers and scrapers	47	63	65	75	62	56	22	13
T	Operating specialized equipment	65	73	65	75	62	53	26	8
U	Operating cranes and attachments	40	48	49	64	57	53	23	12
V	Operating miscellaneous equipment	68	75	81	81	64	65	25	18
W	Performing snow removal functions	35	50	56	52	40	47	41	25
X	Rigging hoisting equipment	35	32	39	51	36	45	17	10
Y	Performing missile support functions	18	9	14	13	11	6	4	0
Z	Operating well drilling equipment	2	1	1	3	2	1	0	2

Tables 6 and 7 show the average relative time spent on each duty (by skill level) for the two specialties and for the superintendent level. Estimated relative time spent values less than 5% have been omitted to more clearly show the separation of the two specialties and to indicate extensive overlap of functions. Two duties (N and P) stand out as being jointly performed by both specialties. However, the relative time spent by the pavements maintenance personnel far exceeds the time spent by the construction equipment operators in the performance of grounds maintenance. The reverse is true for the operation of trucks, front end loaders, and forklifts, but the difference is not so great.

Table 6. **Percent Time Spent in Duties by Pavements Maintenance Personnel[a]**

Duty	Title	55130 N=620 Civ	55130 N=85 Mil	55150 N=542 Civ	55150 N=1,082 Mil	55170 N=132 Civ	55170 N=183 Mil
A	Organizing and planning					10.44	11.53
B	Directing and implementing					13.23	16.79
C	Inspecting and evaluating					7.15	5.99
D	Training						5.62
E	Working with forms, records, reports, directives, or technical data					13.42	16.70
F	Performing laboratory and field tests						
G	Constructing and maintaining rigid pavements and concrete structures		24.91	7.85	20.68		9.58
H	Constructing and maintaining flexible pavements		8.13		7.72		
I	Constructing and maintaining drainage systems		6.13		5.13		
J	Building bunkers and revetments						
K	Constructing and maintaining prefabricated surface mats						
L	Working with explosives						
M	Constructing and maintaining railroad trackage						
N	Performing ground maintenance	52.59	20.40	38.65	14.50	20.31	6.13
O	Applying herbicides and fungicides					5.23	
P	Operating trucks, front end loaders, and forklifts	8.40	15.24	10.78	15.24		5.42
Q	Operating industrial tractors and attachments	6.88		7.48			
R	Operating graders						
S	Operating dozers and scrapers						
T	Operating specialized equipment						
U	Operating cranes and attachments						
V	Operating miscellaneous equipment						
W	Performing snow removal functions		6.17		6.35		
X	Rigging hoisting equipment						
Y	Performing missile support functions						
Z	Operating well drilling equipment						

[a]Less than 5% time spent omitted.

Table 7. **Percent Time Spent in Duties by Construction Equipment Personnel and Superintendents[a]**

Duty	Title	55131		55151		55171		55191	
		N=62 Civ	N=147 Mil	N=437 Civ	N=819 Mil	N=53 Civ	N=177 Mil	N=69 Civ	N=[illegible] Mil
A	Organizing and planning					7.23	7.64	13.58	18.83
B	Directing and implementing					8.54	16.27	20.73	25.23
C	Inspecting and evaluating							11.48	13.39
D	Training						6.85		6.64
E	Working with forms, records, reports, directives, or technical data					10.52	11.86	22.63	20.98
F	Performing laboratory field tests								
G	Constructing and maintaining rigid pavements and concrete structures								
H	Constructing and maintaining flexible pavements								
I	Constructing and maintaining drainage systems								
J	Building bunkers and revetments								
K	Constructing and maintaining prefabricated surfacemats								
L	Working with explosives								
M	Constructing and maintaining railroad trackage								
N	Performing ground maintenance	13.51	7.25	8.02	5.80				
O	Applying herbicides and fungicides								
P	Operating trucks, front end loaders, and forklifts	18.62	30.13	16.33	21.80	8.69	9.80		
Q	Operating industrial tractors and attachments	6.23	5.93	6.11	5.72				
R	Operating graders		6.71	8.90	8.63	6.52	6.61		
S	Operating dozers and scrapers	9.00	9.07	9.90	9.31	7.76	6.76		
T	Operating specialized equipment	12.39	9.48	6.84	8.32				
U	Operating cranes and attachments			6.95	6.43	8.10	5.78		
V	Operating miscellaneous equipment	8.24	6.41	13.68	6.48	6.77			
W	Performing snow removal functions		7.32	7.10	5.97				
X	Rigging hoisting equipment								
Y	Performing missile support functions								
Z	Operating well drilling equipment								

[a] Less than 5% time spent omitted.

Table 8 shows the average civilian and military grade levels for each of the specialties (by skill level). Considerable differences exist between the Wage Grades held by the civilian employees within the two specialties by skill level, with the equipment operators having generally higher grades at each skill level. However, within the military group the grades held by skill level are very nearly the same for the two specialties.

Hierarchical Grouping

The results of hierarchical grouping are shown in Figure 1. For the purpose of comparing civilian and military members, the grouping diagram has been truncated to show only the primary job clusters. Representative titles based on major work functions have been furnished to differentiate between the groups.

Duty descriptions for civilian and military performance in each of the job clusters are shown in Appendix A. The average grade level of the civilian and military members is listed in Table 9. Table 10 lists the major functions performed by the members within each cluster. Considerable overlap of functions among job clusters is apparent with a total of 18 functions identified. The most prev-

Table 8 Average Civilian and Military Grade by Specialty

Specialty Title	AFSC	Average Grade: Civilian GS	WG	WL	WS	Military
Apprentice Pavements Maintenance Specialist	55130	4.0	5.1	-*	6.0	3.2
Pavements Maintenance Specialist	55150	2.7	6.2	6.1	4.7	4.0
Pavements Maintenance Technician	55170	8.3	8.3	5.9	6.8	5.8
Apprentice Construction Equipment Operator	55131	-	7.8	-	-*	2.9
Construction Equipment Operator	55151	-	8.6	6.7	7.1	4.1
Construction Equipment Technician	55171	-	9.7	-*	7.8	5.8
Pavements and Construction Equipment Superintendent	55191	-*	10.5	-	10.2	7.3

*Data has been omitted – only one incumbent in the cell.

alent functions appearing among the clusters are operating light equipment and performing grounds maintenance. As was done for the specialty groups, comparisons were made between civilian and military members on six job variables. The results of these comparisons appear in Appendix B.

Equipment Utilization

Twenty items of equipment were selected from the job inventory based on utilization by at least 30% of the members of either career ladder. Table 11 compares civilian and military utilization of this equipment by career ladder, with the superintendent personnel excluded.

Within the Pavements Maintenance area all pieces of equipment, except two, are used by a significantly greater number of military members than civilian employees. The exceptions are the 6,000-pound forklift, which is used equally by both groups, and the industrial tractor, used more extensively by the civilian employees.

Construction equipment personnel in both groups use the equipment quite similarly. Slightly more than one-half of the equipment items are used to the same extent by both civilian and military members. In five out of the twenty items, military personnel use the items significantly more than the civilian members. The four instances in which the civilian members use equipment to a greater extent than the military personnel involves only two functions–forklift operation and snow removal.

Stacy (1973) reported that the airmen in the Pavements Maintenance and Construction Equipment Operator career fields felt that civilian members and senior level airmen were relied upon more to perform the more technical tasks than were the 3- and 5-skill-level airmen and that generally there was a lack of available construction equipment. The equitable utilization of equipment appears to have improved considerably since Stacy's report, as reflected by the relatively high percentages of civilian and military construction equipment personnel using the equipment. Scheduling of civilian and military personnel on tasks requiring highly developed skills (e.g., equipment operation) seems to have improved to a great extent. Within the Pavements Maintenance area, considerably more airmen are using equipment skills than are civilian employees, while within the Construction Equipment Operator area, equipment skill utilization is approximately equal between the two groups.

Comparison of Military Data Collected in 1969 and 1974

The job inventory used for data collection in 1969 was comprised of 14 duties (encompassing 314 tasks) in contrast to the revised job inventory used in the current study which was composed of 26 duties covering 927 tasks. Some modifications and updating of equipment items also occurred in the 1974 version of the job inventory. Although the job inventories used for data collection in 1969 and 1974 are not identical, sufficient similarities exist between the two to allow some comparisons to be made.

Equipment Utilization. Added evidence, for the apparent improvement in equipment utilization by airmen, was found when 1969 airman survey data was compared to 1974 data. Items of equipment that were listed in both job inventories were com-

Figure 1. **Hierarchical clustering diagram.**

Table 9. Average Civilian and Military Grade by Job Cluster

Job Cluster Title	Group	Average Grade				
		Civilian				Military
		GS	WG	WL	WS	
Supervisor/NCOIC	582	7.7	8.5	6.8	8.8	6.2
Controller, Pavements and Grounds	070	--	--*	--	--*	4.5
Controller, Vehicle	072	--	7.3	--	--*	4.7
Pavements Maintenance Helper	390	--	6.0	6.0	--*	3.7
Pavements Maintenance Specialist	394	--	6.6	--*	--*	4.2
Asphalt Specialist	344	--	7.3	--	--	3.4
Pavements Maintenance Foreman/ NCOIC	425	--	8.0	--	8.0	5.3
Concrete Specialist	542	--	5.3	--	--	3.3
Heavy Equipment Operator	415	--	9.3	8.0	9.2	4.3
Special Equipment Operator	248	--	7.6	--	--*	3.8
Front End Loader Operator	199	--	8.4	--	--	3.8
Vehicle Inspector	237	--	8.7	--	--	4.3
Grounds Maintenance Foreman	411	--*	7.4	5.1	5.8	5.2
Airfield Clearing/Grounds Maintenance Worker	558	--	6.4	5.3	4.0	4.0
Grounds Maintenance Worker/ Industrial Tractor Operator	589	--	5.5	7.5	5.7	4.0
Laborer/Gardener	187	5.0	4.2	6.0	5.4	3.6
Industrial Tractor Operator/ Grounds Maintenance Worker	190	--	5.6	--	--	4.0
Railroad Track Repairman/ Grounds Maintenance Worker	354	--	4.6	--	2.5	4.1
Dump Truck Driver	048	--	6.4	--	--	3.6
Dozer and Grader Operator	039	--	9.1	--	--*	4.7
Pavements Maintenance Laborer	064	--	3.7	--	--*	3.7
Airfield Sweeper	068	--	7.7	--	--	3.4
Litter Patrol/Grounds Maintenance Worker	021	--	5.8	--	--	3.4
Truck Driver/Refuse Collector	649	--	6.6	--	--*	3.5

*Data omitted – only one incumbent in cell.

Table 1 Major Functions Performed by Members of Each Job Cluster

Job Cluster	Title	Primary	Secondary	Tertiary
182	Supervisor/NCOIC	Organizing and Planning	Directing and Implementing	Forms Maintenance
070	Controller, Pavements and Grounds	Forms Maintenance	Organizing and Planning	Inspecting and Evaluating
072	Controller, Vehicle	Forms Maintenance	Directing and Implementing	Operating Light Equipment
390[a]	Pavements Maintenance Helper	Rigid Pavement and Concrete Maint.	Flexible Pavement Maintenance	Drainage System Maintenance
394[a]	Pavements Maintenance Specialist	Rigid Pavement and Concrete Maint.	Flexible Pavement Maintenance	Drainage System Maintenance
344	Asphalt Specialist	Flexible Pavement Maintenance	Drainage System Maintenance	Rigid Pavement and Concrete Maint.
425	Pavements Maintenance Foreman/NCOIC	Organizing and Planning	Directing and Implementing	Inspecting and Evaluating
542	Concrete Specialist	Rigid Pavement and Concrete Maint.	Flexible Pavement Maintenance	Grounds Maintenance
415	Heavy Equipment Operator	Operating Light Equipment	Operating Dozers and Scrapers	Operating Graders
248	Special Equipment Operator	Operating Light Equipment	Grounds Maintenance	Operating Industrial Tractors
199	Front End Loader Operator	Operating Light Equipment	Operating Dozers and Scrapers	Operating Industrial Tractors
237	Vehicle Inspector	Vehicle Inspection and Maintenance	Equipment Inspection and Maint.	Operating Light Equipment
411	Grounds Maintenance Foreman	Organizing and Planning	Directing and Implementing	Grounds Maintenance
558	Airfield Clearing/Grounds Maintenance Worker	Grounds Maintenance	Operating Light Equipment	Operating Industrial Tractors
589	Grounds Maintenance Worker/ Industrial Tractor Operator	Grounds Maintenance	Operating Industrial Tractors	Applying Herbicides and Fungicides
187	Laborer/Gardener	Grounds Maintenance	Operating Light Equipment	Drainage System Maintenance

Table 10. (*Continued*)

Job Cluster	Title	Primary	Secondary	Tertiary
190	Industrial Tractor Operator/ Grounds Maintenance Worker	Grounds Maintenance	Operating Industrial Tractors	Operating Light Equipment
354	Railroad Track Repairman/ Grounds Maintenance Worker	Maintaining Railroad Trackage	Grounds Maintenance	Operating Light Equipment
048	Dump Truck Driver	Operating Light Equipment	Grounds Maintenance	Drainage System Maintenance
039	Dozer and Grader Operator	Operating Graders	Operating Dozers and Scrapers	Operating Light Equipment
064	Pavements Maintenance Laborer	Flexible Pavement Maintenance	Rigid Pavement and Concrete Maint.	Operating Light Equipment
068	Airfield Sweeper	Operating Specialized Equipment	Grounds Maintenance	Operating Light Equipment
021	Litter Patrol/Grounds Maintenance Worker	Grounds Maintenance	Directing and Implementing	Operating Light Equipment
649	Truck Driver/Refuse Collector	Operating Miscellaneous Equipment	Forms Maintenance	Directing and Implementing

[a]A higher average grade level differentiates Job Cluster 394 from 390.

Table 11. Percentage of Civilian and Military Members Using Equipment

Equipment	Career Ladder[a] Pavements Maintenance Civilian	Military	x^2	Construction Equipment Civilian	Military	x^2
Airfield vacuum sweepers	17	38	157.692***	52	62	110.822***
Asphalt distributors	[illegible]	42	278.372***	25	24	.118
Combination snow plows	26	31	8.024**	40	29	20 730***
Cranes, 20 ton	5	9	19.432***	43	66	83.884***
Crawler tractors, D6	13	16	4.792*	59	69	16.724***
Dump trucks, 5 ton	[illegible]	70	154.473***	69	68	.529
Forklifts, 6,000 lbs	[illegible]	32	.692	61	52	18.423***
Forklifts, 15,000 lbs	24	31	18.188***	58	53	3.971*
Front end loaders	43	64	128.111***	77	89	47.560***
Graders	16	32	95.815***	66	85	76.347***
Industrial tractors	40	21	118.459***	45	43	.755
Magnetic sweepers	17	31	63.907***	54	54	.005
Pneumatic rollers	13	33	144.996***	41	42	.113
Rollover snow plows	21	34	56.740***	37	32	3.494
Snow blowers	26	35	28.799***	40	34	5.313*
Snow sweepers	22	32	33.016***	36	34	1.070
Steel wheel rollers	13	43	306.598***	44	43	.097
Street sweepers	18	33	86.463***	53	56	1.123
Towed sweepers	24	29	9.500**	45	49	2.583
Tractor trucks	18	22	5.337*	57	59	.554

[a]Does not include Superintendents (AFSC 55191).
*Differences significant at .05 level of confidence.
**Differences significant at .01 level of confidence.
***Differences significant at .001 level of confidence.

pared and the results shown in Table 12. There has been a significant increase in usage for most items of equipment in both career ladders. The two instances in which the use of equipment has since decreased (both career ladders) involve skill equipment not specific to either Pavements Maintenance of Construction Equipment Operator.

Job Interest and Utilization of Training and Talents. The fairly high correlation of job interest with job utilization of training and talents (r = .69) reported earlier (see Table 3), is supported by the concomitant increases in job utilization of training and talents and job interest reported by military members in 1974. Conversely, for the 7- and 9-skill levels job interest drops as job utilization of training and talents decreases. However, the overall job interest and job utilization for the total samples are significantly higher in 1974 than in 1969 (see Tables 13 and 14).

Comparison of Civilian and Military Members Who Have from 1 to 48 Months of Service by Specific Job Type

Since there is a considerable difference between civilian and military members as to the number of months on the job (see Table 2), comparisons were made between the two groups for members who have between 1 and 48 months of service. Three job types were computed based on membership in specific hierarchical groups (see Figure 1). Members in Groups 558, 589, 187, 190, and 021 were considered grounds workers. The equipment operator job type was developed from groups 415, 248, and 199. Pavements workers encompassed members from groups 390, 394, and 064.

Table 15 shows the relative percent time spent on the ten most time-consuming tasks for each job type by civilian and military members (see asterisked tasks) as well as the time spent on the combined task listing of the three groups.

A summation of percentage of time spent for only the top ten tasks indicates that the tasks account for nearly one-third of the civilian grounds workers time and slightly more than one-fourth of the military grounds workers' time, with a difference between the two groups of less than four percent.

The ten most time-consuming tasks for the civilian equipment operators account for only

Table 12. **Percentage of Military Members Using Equipment at Two Points in Time**

Equipment	Career Ladder[a] Pavements Maintenance 1969 Data	1974 Data	x^2	Construction Equipment 1969 Data	1974 Data	x^2
Airfield vacuum sweeper	21	38	80.109***	59	62	110.822***
Asphalt distributors	2	42	531.642***	2	24	194.631***
Cranes, 20 ton	2	9	47.936***	28	66	288.339***
Crawler tractor, D6	8	16	31.005***	50	69	76.612***
Dump trucks, 5 ton	73	70	2.452	79	68	33.992***
Front end loaders	34	64	223.523***	63	89	194.348***
Graders	11	32	156.434***	43	83	384.454***
Industrial tractors	47	21	194.863***	58	43	43.337***
Magnetic sweepers	20	31	33.869***	35	54	70.643***
Pneumatic rollers	10	33	171.380***	23	42	86.418***
Steel wheel rollers	18	43	167.071***	34	43	15.804***
Street sweepers	22	33	39.571***	40	56	50.878***
Tractor trucks	18	22	5.277*	52	59	9.757**

[a]Does not include Superintendents (AFSC 55191).
*Differences significant at .05 level of confidence.
**Differences significant at .01 level of confidence.
***Differences significant at .001 level of confidence.

Table 13. **Comparison of 1969 and 1974 Military Samples on Job Interest**

Skill Level	AFSC	1969 Data N	Mean	SD	1974 Data N	Mean	SD	t-test
3	55130	223	3.23	1.84	85	3.62	1.87	1.655
	55131	168	4.37	1.60	147	4.82	1.49	2.571*
5	55150	745	3.61	1.73	1,082	3.85	1.74	2.904**
	55151	603	4.68	1.66	819	4.87	1.59	2.186*
7	55170	118	5.41	1.32	183	5.23	1.50	1.064
	55171	91	5.96	1.53	177	5.60	1.36	1.966*
9	55191	14	6.43	0.73	60	6.00	0.98	1.542
Total		1,978	4.19	1.82	2,675	4.48	1.75	5.482***

*Significantly different at .05 level of confidence.
**Significantly different at .01 level of confidence.
***Significantly different at .001 level of confidence.

Table 14. **Comparison of 1969 and 1974 Military Samples on Job Utilization**

Skill Level	AFSC	1969 Data N	Mean	SD	1974 Data N	Mean	SD	t-test
3	55130	223	2.39	1.37	85	2.57	1.54	0.995
	55131	168	3.05	1.51	147	3.46	1.43	2.464*
5	55150	745	2.68	1.44	1,082	2.95	1.45	3.922**
	55151	603	3.41	1.57	819	3.58	1.62	1.981*
7	55170	118	4.65	1.66	183	4.24	1.66	2.092*
	55171	91	4.49	1.68	177	4.42	1.59	0.335
9	55191	14	5.79	1.21	60	5.24	1.72	1.130
Total		1,978	3.13	1.64	2,675	3.39	1.63	5.306**

*Significantly different at .05 level of confidence.
**Significantly different at .001 level of confidence.

Table 15. **Percent Time Spent on Top Ten Tasks for Three Job Types by Civilian and Military Members**

D-TSK	Task Title	Percent Time					
		Grounds Workers		Equipment Operators		Pavements Workers	
		Civ	Mil	Civ	Mil	Civ	Mil
B12	Direct gunnery range maintenance operations	.02	2.50[a]	.03	.02	.00	.01
G 3	Break concrete using air hammers	.17	.29	.20	.33	1.59[a]	1.81[a]
G21	Hand shovel concrete	.17	.42	.09	.21	1.13[a]	1.51[a]
G32	Mix concrete by hand	.17	.22	.11	.15	.93	1.31[a]
G37	Perform operator inspections or maintenance of air compressors or air tools	.05	.02	.10	.13	1.03[a]	.84
G55	Set up air compressors and pneumatic tools	.05	.20	.14	.20	1.33[a]	1.55[a]
H 2	Apply bituminous materials by hand	.01	.06	.07	.18	.57	1.27[a]
H 3	Compact asphalt by hand	.05	.07	.16	.20	1.20[a]	1.30[a]
H 8	Cut or remove asphalt from areas	.05	.11	.29	.26	1.48[a]	1.50[a]
I 2	Dig ditches by hand	.58	.70	.21	.45	1.22[a]	1.24[a]
N11	Chop vegetation from joints or cracks in pavements	2.29[a]	1.33	.15	.15	.57	.54
N20	Cut weeds	4.40[a]	4.15[a]	.32	.41	.82	.70
N23	Edge grassy areas by hand	2.64[a]	1.97[a]	.15	.13	.36	.29
N48	Mow grass with hand mowers or self-propelled mowers	4.41[a]	3.86[a]	.25	.33	.54	.42
N49	Mow grass with towed mowers	3.16[a]	2.26[a]	.39	.35	.30	.32
N53	Perform operator inspections or maintenance on mowers	3.23[a]	1.38	.26	.19	.26	.23
N55	Perform shop maintenance on mowers	1.67[a]	1.14	.15	.11	.25	.15
N60	Police grounds for litter	3.51[a]	4.30[a]	.32	.77	.43	.81
N64	Remove trees or shrubs by hand	1.89[a]	1.95[a]	.22	.17	.38	.28
N80	Trim trees or shrubs	3.19[a]	2.53[a]	.20	.13	.39	.33
P 8	Backfill excavations with front end loaders	.15	.14	.79[a]	.95	.38	.22
P10	Drive front end loaders to or from work areas	.28	1.23	.90[a]	1.27[a]	.45	.44
P12	Dump materials from dump trucks	.85	1.31	.96[a]	1.75[a]	1.05[a]	1.38[a]
P15	Haul materials with dump trucks	1.03	1.49[a]	1.00[a]	1.79[a]	1.13[a]	1.42[a]
P17	Level areas by backdragging front end loaders	.18	.22	.81[a]	1.08[a]	.42	.26
P19	Load materials using front end loaders with multipurpose buckets	.16	.24	.65	.99[a]	.32	.26
P20	Load materials with front end loaders	.28	.40	1.01[a]	1.53[a]	.58	.50
P23	Move materials with front end loaders	.29	1.81	.92[a]	1.23[a]	.51	.36
P24	Perform operator inspections or maintenance on dump trucks	.97	1.55[a]	1.05[a]	1.71[a]	1.10[a]	1.19
P25	Perform operator inspections or maintenance on front end loaders	.33	.36	1.02[a]	1.50[a]	.45	.38
P32	Spread materials from dump trucks	.46	.60	.80[a]	1.14[a]	.77	.90
	Total Percent Time	36.69	38.81	13.72	19.81	22.04	23.72

[a]Indicates top ten tasks for each group.

about ten percent of their time, while nearly fourteen percent for the military equipment operators. The relatively small amount of time for both groups seems to indicate that the job performed by the equipment operators is considerably more diversified than the job of the grounds workers.

Percentages of time spent on the top ten tasks by the civilian and military pavements workers are more similar than for either the grounds workers or the Construction Equipment Operators, with a difference in time spent between the two groups of less than two percent.

Table 16 compares the civilian and military members within each job type as to the number of tasks performed, job difficulty, job utilization of training and talents, and job interest. Significant differences were found between civilian and military members in the equipment operator job type in all four variables. Within the grounds worker and pavements worker job types, only job utilization and job interest were significantly different for the two groups.

An analysis of variance test was computed for the civilian and military members across job types within each of the four variables. Significant differences were found for both groups in all four variables. A protected t-test (Welkowitz, Ewen, & Cohen, 1976, p. 220) was then computed between each of the pairs of means by job type. Since the job types were formed through the process of hierarchical grouping of individuals, with highly similar work patterns, significant differences would be expected between job types in the number of tasks performed and job difficulty, but not necessarily in job utilization and job interest. Table 17 shows the summary of t-values obtained for pairs of means tested. Results were as expected for both civilian and military dyads. The civilian grounds worker versus pavements worker pair failed to show a significant difference, in job utilization and job interest, while the military equipment operator *vs.* pavements worker pair were not significantly different in number of tasks performed.

Stacy (1973) reported that 51% of the first-term airmen (1–48 months service) indicated that they were poorly utilized, while 49% of the airmen considered themselves to be well utilized. Ratings were made on a scale of 1 to 7, with 1 indicating that training and talents were utilized "not at all" and 7 indicating that training and talents were utilized "perfectly." Scale ratings of 1 and 2 ("not at all" and "very little") were established as indicating poorly utilized airmen while scale ratings 3

Table 16. Means, Standard Deviations, and t-tests for Civilian and Military Group Members' Performance in Four Variables by Job Type

		Variables											
		Number of Tasks Performed			Job Difficulty			Job Utilization of Training and Talents			Job Interest		
Job Type and Group	N	Mean	SD	t-test	Mean	SD	t-test	Mean	SD	t-test	Mean	SD	t-test
Grounds Workers													
Civilian	518	55.62	46.69	1.19	8.57	4.17	0.27	3.51	1.68	7.60[a]	4.83	1.48	10.97[a]
Military	124	49.90	41.92		8.45	3.86		2.24	1.28		3.02	1.85	
Equipment Operators													
Civilian	75	157.19	92.17	6.85[a]	16.86	4.08	5.76[a]	4.35	1.70	5.01[a]	5.47	1.20	4.51[a]
Military	648	101.01	63.78		13.98	4.10		3.41	1.52		4.59	1.64	
Pavements Workers													
Civilian	57	110.00	52.03	1.48	12.87	4.01	1.64	3.60	1.23	4.18[a]	5.09	1.17	6.14[a]
Military	464	97.16	62.84		11.87	4.38		2.81	1.36		3.66	1.71	

[a]Significantly different at .001 level of confidence.

Table 17. **Summary of t-values Between Groups After ANOVA Testing**

Variable and Group	Job Types		
	Grounds Worker vs. Equipment Operator	Grounds Worker vs. Pavements Worker	Equipment Operator vs. Pavements Workers
Number of tasks performed			
Civilian	13.83**	6.60**	4.69**
Military	8.47**	7.56**	1.03
Job difficulty			
Civilian	15.65**	7.25**	5.50**
Military	13.49**	8.05**	8.29**
Job utilization of training and talents			
Civilian	4.02**	0.38	2.62*
Military	8.29**	3.91**	6.82**
Job Interest			
Civilian	3.67**	1.33	2.17*
Military	9.49**	3.73**	9.07**

*Significantly different at .01 level of confidence.
**Significantly different at .001 level of confidence.

through 7 ("fairly well" to "perfectly") were considered an indication of well utilized airmen (See Appendix E for Stacy's tabular data.)

Identical definitions of poorly and well utilized ratings were used in this study for civilians and airmen with 1 to 48 months of service. Currently, 56% of the airmen report being well utilized while 44% are poorly utilized. Although this is a considerable improvement, over data collected in 1969, the percentage of poorly utilized airmen is still rather high. In contrast, only 26% of the current civilian members report being poorly utilized, while 74% indicate that they are well utilized. Nevertheless, if job satisfaction is inferred from reports of felt utilization, then the job satisfaction of the first-term airman has shown a modest increase since 1969 (see Table 16 and Appendix C).

Table 18 shows the means, standard deviations, and t-values for each civilian/military pair within the poorly utilized and well utilized groups for three job variables. Significant differences were found between civilian and military members in both utilization groups for all three variables. Military members of both utilization categories appear to perform more tasks of greater difficulty than do the civilian employees, although the civilian members express greater job interest in the jobs they perform. The significantly greater number of tasks performed by first-term airmen seems to be indicative of a greater emphasis on training in more varied tasks than for the civilian members during the first four years. As noted earlier (see Table 2), no significant difference was found between civilian and military members for total samples.

Table 19 shows that the military personnel in the poorly utilized and well utilized groups spend significantly less time than do the civilian members in performing grounds maintenance tasks, $X^2 = 26.36$, $df = 1$, $p < .001$ for the poorly utilized group and $X^2 = 21.31$, $df = 1$, $p < .001$ for the well utilized group. No difference exists between the civilian members by utilization groups, nor is there a difference between the military members by utilization groups. A review of the composite task descriptions for the poorly utilized and well utilized civilian and military members revealed that for the civilian members of the poorly utilized group all of the top ten tasks of the description were duty N (performing ground maintenance) tasks, while for the military personnel of the same group, only two of the top ten tasks were duty N tasks. For the civilian members of the well utilized group, nine out of the ten tasks were duty N tasks, while for the military members of the same group, only one of the ten tasks was a duty N task. Significant differences were also found between the civilian and military members by utilization group in the percent of members performing duty N. For the civilian and military pair of the poorly utilized group, $X^2 = 11.49$, $df = 1$, $p < .001$ and for the same pair of well utilized group, $X^2 = 6.87$, $df = 1$, $p < .01$. No differences are apparent, however, between civilian or military groups by utilization category.

Data for duty N (performing grounds maintenance) for the three job types are shown in Table 20. Although no statistical tests were computed

Table 18. **Means, Standard Deviations, and t-tests for Civilian and Military Members of Poorly and Well Utilized Groups on Three Variables**

Groups	N	Variables: Number of Tasks Performed Mean	SD	t-test	Job Difficulty Mean	SD	t-test	Job Interest Mean	SD	t-test
Poorly utilized										
Civilian	145	56.59	61.41	2.58**	8.75	5.11	4.63***	3.66	1.48	5.65***
Military	662	70.36	57.44		10.62	4.24		2.82	1.65	
Well utilized										
Civilian	412	88.74	78.50	2.29*	11.35	5.01	5.73***	5.54	1.00	8.10***
Military	854	100.58	89.82		12.97	4.57		4.98	1.22	

*Significantly different at .05 level of confidence.
**Significantly different at .01 level of confidence.
***Significantly different at .001 level of conficence.

Table 19. **Comparison of Poorly and Well Utilized Civilian and Military Members on Duty N – Performing Grounds Maintenance**

Groups	N	Percent Members Performing	Percent Time Spent
Poorly Utilized			
Civilian	145	94.48	49.09
Military	662	77.95	15.18
Well Utilized			
Civilian	412	91.26	37.40
Military	854	77.87	9.70

Table 20. **Comparison of Three Job Types on Duty N – Performing Ground Maintenance**

Job Type and Group	N	Percent Members Performing	Percent Time Spent
Grounds Workers			
Civilian	318	100.00	59.48
Military	124	97.58	48.45
Equipment Operators			
Civilian	75	86.67	7.51
Military	648	79.32	7.48
Pavements Workers			
Civilian	57	87.72	11.95
Military	464	82.33	10.50

for the differences between duty performance in duty N for the civilian and military members, the military members in all three job types spend less time in the duty than do the civilian members. It is not possible to compare data in Tables 19 and 20 with the data contained in Table C1 (Appendix C), since only nine tasks were included under duty N in the 1969 version of the job inventory, while the current version contains 82 tasks under duty N. Data are provided in Appendix C only for the purpose of reference.

The findings of no difference between civilian or military members by utilization groups in the performance of duty N tasks seems to indicate that grounds maintenance tasks are assigned impartially to both civilian and military members regardless of how well the members may perceive they are being utilized on the job.

IV. SUMMARY AND CONCLUSION

This study analyzed duty performance of civilian and military members of the Pavements Maintenance and Construction Equipment Operator Career Ladders as well as the Pavements and Construction Equipment Superintendent to assist Civil Engineering in defining utilization patterns of the two groups.

When considering the total group data, no significant difference is found between the civilian and military members as to number of tasks performed. However, average task difficulty and job difficulty show higher quantitative levels for the military members than for civil service employees. The ratios indicating significant differences between means for these factors are significant beyond the .01 level of confidence.

Within each specialty, the situation is mixed, with civilian members indicating a significantly greater number of tasks performed in five out of the seven skill levels. Average task difficulty differences were found only for the 9-skill-level group, with the military members performing tasks significantly more difficult than the civilian members. In three of the seven skill levels, the civilian members appear to be performing significantly more difficult jobs, but this is probably a function of the greater number of tasks performed.

As expected, significant differences are found for all skill levels and for the total sample in the number of months on the job, reflecting the more transitory requirement of the military members who have considerably less time in the job than their civilian counterparts.

In all but two AFSCs, the civilian members indicate significantly higher average job interest than their counterparts, with no significant differences between the two groups for the Construction Equipment Technicians and Pavements and Construction Equipment Superintendents. The civilian members also indicate significantly higher average job utilization, with one exception. No significant difference is found between the two groups at the superintendent level.

Generally, the duty performance of the two groups is quite similar within specialties. However, duties G and H (constructing and maintaining rigid and flexible pavement and concrete structures) are performed by a considerably larger percentage of military members than civilian employees within the Pavements Maintenance career ladder. Applying herbicides and fungicides (duty O) appears to be primarily a civilian employee function rather than a military function, both in the Pavements Maintenance and Construction Equipment Operator career ladders.

Percentages of time spent by the two groups on duties are quite similar, again with some differences noted. A considerably greater amount of time is spent performing ground maintenance tasks (duty N) by the civilian members than by the military personnel. This holds true for both career ladders. However, more time is spent on duty D (training) by the military members than by the civilian members. When the data are restricted to time spent estimates of 5% or more, it is apparent that the functions of the pavements maintenance personnel (both civilian and military) overlap into the equipment operator area (duty P – operating trucks, front-end loaders, and forklifts), but a similar overlap by functions of the construction equipment operator into the pavements maintenance area is not apparent.

Within the Pavements Maintenance career ladder, the operation of equipment is primarily a military function. Differences between civilian and military members operating equipment in the Construction Equipment Operator career ladder are minor, indicating that the two groups function quite similarly.

Stacy (1973) suggested that improved utilization of equipment might increase job interest and job utilization among military members. In this light, comparisons were made between military data collected in 1969 and current data. It was found that there has been a significant increase in equipment utilization by the military in both career ladders during this time period, with a resulting increase in job interest and felt utilization

at the 3- and 5-skill levels of both career ladders. However, the job interest and felt utilization of the 7-skill-level members for both career ladders generally showed a slight drop.

In an effort to equalize civilian and military personnel according to length of service, comparisons were made between civilian and military members who have between 1 and 48 months of service. Three job types (grounds maintenance, equipment operators, and pavements workers) were compared. Comparisons were also made between civilian and military members who were defined as poorly utilized and well utilized employees.

The top ten tasks performed by the civilian grounds maintenance workers include only ground maintenance tasks such as cutting weeds, mowing grass, etc., whereas, the military members additionally perform directing, inspecting, and hauling tasks. This seems to indicate that some improvement has been made in the utilization of first-term airmen in performing tasks other than grounds maintenance. The time spent by the equipment operators and pavements maintenance civilian and military personnel on the top ten tasks produces a highly similar listing of tasks for each group, with only minor variations.

The average numbers of tasks performed by civilian and military members within the grounds maintenance and pavements maintenance job types are quite similar. However, the civilian members of the equipment operator group perform significantly more tasks than the military members. This difference in average number of tasks performed may indicate a lack of opportunity for the first-term airmen to operate equipment, but probably is more indicative of broader task recognition on the part of the highly skilled civilian employee compared to the relatively inexperienced first-term airman.

The lowest job difficulty indexes are found for the civilian and military members of the grounds workers job type, but with no significant difference between the two groups. A significant difference is apparent, however, between the members in the equipment operator job type, probably a function of the difference in number of tasks performed.

For all three job types, the civilian members expressed significantly greater job interest and job utilization than did the military members. The lowest ratings were rendered by the military grounds workers.

A considerable difference exists between civilians and airmen as to reported utilization. Fifty-six percent of the airmen report being well utilized, while 74% of the civilian employees report being well utilized. Compared to 1969 data (see Appendix C), there has been an improvement in the percentage of military personnel reporting being well utilized (an increase of 5%). In the poorly utilized and well utilized dichotomy, the military members performed significantly more tasks than the civilian employees, but military members reported their jobs significantly less interesting in both utilization categories than did the civilian members.

Considerable improvement appears to have taken place in the utilization of first-term airmen in grounds maintenance (duty N). In 1969, 19% of the first-term sample clustered into the grounds worker job type (see Appendix C). However in the current study, only 10% of the first-term airmen appeared in this grouping.

The problems identified by Stacy (1973) appear to have diminished considerably, as evidenced by the reduction in utilization of airmen in grounds maintenance tasks, and in the more equitable utilization of equipment items by civilian and military personnel. This determination of improved airmen utilization was an important objective of this study and the results of the improvement, probably brought about through the efforts of civil engineering managers, is reflected in highly satisfactory retention rates of military members in the Pavements Maintenance and Construction Equipment Operator career ladders.

REFERENCES

AF Manual 26-1. *Manpower policies and procedures.* Washington, D.C.: Department of the Air Force, 8 May 1973.

AF Manual 35-2. *Occupational analysis procedures for conducting occupational surveys and Air Force specialty evaluations.* Washington, D.C.: Department of the Air Force, 9 July 1965.

Archer, W.B. *Computation of group job descriptions from occupational survey data.* PRL-TR-66-12, AD-653 543. Lackland AFB, TX: Personnel Research Laboratory, Aerospace Medical Division, December 1966.

Christal, R.E. *The United States Air Force occupational research project.* AFHRL-TR-73-75, AD-774 574. Lackland AFB, TX: Occupational Research Division, Air Force Human Resources Laboratory, January 1974.

Christal, R.E., & Ward, J.H., Jr. The MAXOF clustering model. In M. Lorr & S. B. Lyerly (Eds.), *Proceedings of the conference on cluster analysis of multivariate data.* New Orleans, LA: Catholic University of America, June 1967, 11.02–11.45.

Garza, A.T. *Occupational survey of seven accounting and finance civil service series.* AFHRL-TR-72-67, AD-754 967. Lackland AFB, TX: Personnel Research Division, Air Force Human Resources Laboratory, July 1972.

Garza, A.T., & Carpenter, J.B. *Comparative job attributes of airmen and civil service personnel having similar job types.* AFHRL-TR-74-45, AD-786 407. Lackland AFB, TX: Occupational Research Division, Air Force Human Resources Laboratory, May 1974.

Morsh, J.E., & Christal, R.E. *Impact of the computer on job analysis in the United States Air Force.* PRL-TR-66-19, AD-636 304. Lackland AFB, TX: Personnel Research Laboratory, Aerospace Medical Division, October 1966.

Stacy, W.J. *Felt utilization of talent and training in two civil engineering career ladders.* AFHRL-TR-73-32. Lackland AFB, TX: Occupational Research Division, Air Force Human Resources Laboratory, November 1973. (Available to qualified requestors only.)

Welkowitz, J., Ewen, R.B., & Cohen, J. *Introductory statistics for the behavioral sciences* (2nd ed.). New York: Academic Press, 1976.

APPENDIX A: PERCENT MEMBERS PERFORMING DUTIES BY JOB CLUSTER

Table A1. Percent Members Performing Duties by Job Cluster

Duty	Duty Title	Supervisor/ NCOIC		Controller, Pave and Grds		Controller, Vehicle		Pave Maint Helper		Pave Maint Specialist	
		Civ N=114	Mil N=217	Civ N=2	Mil N=26	Civ N=4	Mil N=32	Civ N=49	Mil N=280	Civ N=95	Mil N=342
A	Organizing and planning	100	100	100	85	25	38	18	26	40	56
B	Directing and implementing	100	100	50	46	75	75	18	42	44	76
C	Inspecting and evaluating	99	93	100	27	0	28	2	8	14	36
D	Training	76	94	0	12	0	13	4	9	21	38
E	Working with forms, records, reports, directives, or technical data	100	99	100	100	100	100	20	33	38	67
F	Performing laboratory and field tests	21	12	50	4	0	3	10	14	20	39
G	Constructing and maintaining rigid pavements and concrete structures	25	29	0	4	0	13	96	100	100	100
H	Constructing and maintaining flexible pavements	18	26	0	12	25	6	96	95	99	100
I	Constructing and maintaining drainage systems	59	56	0	8	0	19	86	90	94	96
J	Building bunkers and revetments	5	1	0	0	0	3	41	28	51	48
K	Constructing and maintaining pre-fabricated surface mats	6	4	0	0	0	6	10	8	23	25
L	Working with explosives	0	1	0	0	0	0	8	2	5	3
M	Constructing and maintaining railroad trackage	16	7	0	8	25	3	22	25	44	44
N	Performing grounds maintenance	61	28	0	8	25	16	63	74	88	89
O	Applying herbicides and fungicides	39	10	0	8	0	3	8	8	22	15
P	Operating trucks, front end loaders, and forklifts	17	23	0	8	25	44	76	90	94	99
Q	Operating industrial tractors and attachments	11	7	0	0	0	9	39	38	82	8
R	Operating graders	4	11	0	0	0	28	6	7	25	2
S	Operating dozers and scrapers	4	8	0	0	0	16	0	2	17	12
T	Operating specialized equipment	9	12	0	0	0	6	12	39	81	81
U	Operating cranes and attachments	5	10	0	0	0	9	10	3	15	10
V	Operating miscellaneous equipment	15	21	0	4	0	25	41	51	63	77
W	Performing snow removal functions	24	30	0	12	25	41	29	39	49	60
X	Rigging hoisting equipment	4	6	0	0	0	9	22	21	43	40
Y	Performing missile support functions	2	2	0	0	0	3	0	3	6	7
Z	Operating well drilling equipment	0	0	0	0	0	0	0	3	2	4

Table A1 (*Continued*)

Duty	Duty Title	Asphalt Specialist		Pave Maint Foreman		Concrete Specialist		Hvy Equip Operator		Spec Equip Operator	
		Civ N=9	Mil N=18	Civ N=36	Mil N=76	Civ N=4	Mil N26	Civ N=314	Mil N=657	Civ N=77	Mil N=347
A	Organizing and planning	22	11	97	100	0	15	38	42	16	22
B	Directing and implementing	33	17	97	100	0	35	51	63	25	35
C	Inspecting and evaluating	11	6	97	97	0	4	21	26	3	9
D	Training	0	11	86	97	0	0	40	40	10	12
E	Working with forms, records, reports, directives, or technical data	22	17	94	96	0	15	42	58	22	37
F	Performing laboratory and field tests	0	6	67	64	0	15	9	5	0	2
G	Constructing and maintaining rigid pavements and concrete structures	89	89	97	96	100	100	51	56	60	51
H	Constructing and maintaining flexible pavements	100	100	97	93	50	65	61	53	51	46
I	Constructing and maintaining drainage systems	100	67	97	93	25	69	81	76	66	65
J	Building bunkers and revetments	44	6	67	50	0	0	42	32	26	23
K	Constructing and maintaining pre-fabricated surface mats	22	22	53	41	25	0	22	26	4	10
L	Working with explosives	22	0	25	24	0	0	4	4	1	0
M	Constructing and maintaining railroad trackage	44	61	61	34	50	12	13	9	12	13
N	Performing grounds maintenance	67	94	89	82	25	38	82	79	84	79
O	Applying herbicides and fungicides	0	0	56	29	0	4	11	6	9	4
P	Operating trucks, front end loaders, and forklifts	78	94	89	86	25	19	99	99	100	100
Q	Operating industrial tractors and attachments	33	56	81	71	0	8	92	89	84	73
R	Operating graders	0	0	69	49	0	0	98	95	44	59
S	Operating dozers and scrapers	0	0	64	32	0	0	99	95	48	51
T	Operating specialized equipment	67	17	86	71	0	8	87	87	77	81
U	Operating cranes and attachments	0	6	69	32	0	0	77	79	26	36
V	Operating miscellaneous equipment	44	39	67	66	0	12	91	93	78	75
W	Performing snow removal functions	0	22	75	53	0	8	69	54	73	72
X	Rigging hoisting equipment	0	33	56	43	25	0	63	69	25	34
Y	Performing missile support functions	0	0	25	17	0	0	21	13	4	9
Z	Operating well drilling equipment	0	0	14	14	0	4	2	4	0	1

Table A1 (*Continued*)

Duty	Duty Title	Frontend Loader Operator		Vehicle Inspector		Grds Maint Foreman		Afld/Grds Maint Wrker		Grds Maint/ Trac Opr	
		Civ N=7	Mil N=66	Civ N=6	Mil N=7	Civ N=93	Mil N=28	Civ N=261	Mil N=59	Civ N=235	Mil N=23
A	Organizing and planning	14	15	0	14	100	100	36	37	28	48
B	Directing and implementing	0	26	17	86	100	100	39	56	33	70
C	Inspecting and evaluating	14	6	0	0	90	93	11	12	7	22
D	Training	14	8	0	29	74	68	18	17	9	17
E	Working with forms, records, reports, directives, or technical data	14	29	50	57	96	93	43	53	23	26
F	Performing laboratory and field tests	0	0	0	0	34	11	9	10	2	0
G	Constructing and maintaining rigid pavements and concrete structures	14	23	50	29	45	57	61	69	19	39
H	Constructing and maintaining flexible pavements	0	15	50	29	16	29	22	44	8	17
I	Constructing and maintaining drainage systems	29	23	0	29	73	82	76	85	42	57
J	Building bunkers and revetments	29	9	0	0	29	14	32	44	11	4
K	Constructing and maintaining pre-fabricated surface mats	14	14	0	0	10	11	8	12	3	4
L	Working with explosives	0	0	0	0	4	0	5	3	3	4
M	Constructing and maintaining railroad trackage	0	2	0	0	18	4	29	34	4	9
N	Performing grounds maintenance	43	44	67	14	100	100	100	100	100	100
O	Applying herbicides and fungicides	0	0	0	0	88	68	68	51	68	43
P	Operating trucks, front end loaders, and forklifts	100	100	83	86	74	82	97	100	63	57
Q	Operating industrial tractors and attachments	57	41	83	43	92	79	97	95	80	74
R	Operating graders	43	41	67	71	18	18	20	31	2	13
S	Operating dozers and scrapers	71	45	83	57	10	7	13	22	2	0
T	Operating specialized equipment	29	32	100	100	43	32	53	54	17	4
U	Operating cranes and attachments	43	21	100	86	6	4	9	3	2	0
V	Operating miscellaneous equipment	14	64	83	86	54	50	77	76	41	39
W	Performing snow removal functions	0	48	33	29	49	39	79	81	26	30
X	Rigging hoisting equipment	14	11	33	29	38	14	39	46	18	13
Y	Performing missile support functions	14	8	17	0	11	7	8	10	0	0
Z	Operating well drilling equipment	0	0	0	0	0	0	2	2	0	0

Table A1 (*Continued*)

Duty	Duty Title	Laborer/ Gardener		Trac Opr/ Grds Maint		RR Repair/ Grds Maint		Dump Trk Driver		Dozer and Grader Opr	
		Civ N=267	Mil N=65	Civ N=24	Mil N=2	Civ N=17	Mil N=8	Civ N=21	Mil N=75	Civ N=20	Mil N=22
A	Organizing and planning	15	11	17	0	35	38	5	11	20	41
B	Directing and implementing	12	25	8	0	47	50	14	17	30	50
C	[illegible]ecting and evaluating	0	3	0	0	12	25	0	1	10	27
D	[illegible]ng	2	3	0	0	24	25	5	4	20	45
E	[illegible]g with forms, records, reports, [illegible]es, or technical data	6	26	33	0	29	13	19	20	20	55
F	Performing laboratory and field tests	2	2	0	0	6	0	0	4	0	5
G	Constructing and maintaining rigid pavements and concrete structures	14	28	17	0	47	38	24	44	0	9
H	Constructing and maintaining flexible pavements	5	9	4	0	12	38	33	32	15	9
I	Constructing and maintaining drainage systems	30	43	17	50	53	88	38	40	15	27
J	Building bunkers and revetments	6	20	8	0	6	25	5	8	5	5
K	Constructing and maintaining pre-fabricated surface mats	0	5	0	0	0	0	0	3	0	0
L	Working with explosives	3	0	0	0	0	0	0	0	0	5
M	Constructing and maintaining railroad trackage	3	11	4	0	100	100	24	5	5	0
N	Performing grounds maintenance	100	100	100	100	88	100	81	63	20	32
O	Applying herbicides and fungicides	21	22	21	50	35	50	5	1	0	0
P	Operating trucks, front end loaders, and forklifts	31	58	54	100	76	88	90	92	65	50
Q	Operating industrial tractors and attachments	22	42	92	100	59	25	24	28	30	23
R	Operating [illegible]aders	2	6	4	50	6	13	0	9	65	91
S	Operating [illegible]ozers and scrapers	2	2	4	50	0	13	0	9	75	55
T	Operating specialized equipment	4	14	21	0	6	13	10	39	30	27
U	Operating cranes and attachments	1	2	0	0	0	0	5	17	30	36
V	Operating miscellaneous equipment	24	34	33	50	35	25	38	37	65	27
W	Performing snow removal functions	15	42	63	0	29	38	33	55	35	27
X	Rigging hoisting equipment	12	18	17	0	18	0	0	11	5	5
Y	Performing missile support functions	0	5	0	0	0	0	0	7	0	5
Z	Operating well drilling equipment	0	2	0	0	0	0	0	0	0	0

Table A1 (*Continued*)

Duty	Duty Title	Pave Maint Laborer		Airfield Sweeper		Litter Patrol/ Grds Maint Wrkr		Trk Drvr/ Refuse Col	
		Civ N=5	Mil N=33	Civ N=23	Mil N=19	Civ N=38	Mil N=16	Civ N=74	Mil N=2
A	Organizing and planning	0	3	17	16	18	13	19	0
B	Directing and implementing	0	52	22	16	13	56	39	50
C	Inspecting and evaluating	0	6	0	5	5	0	7	0
D	Training	0	6	9	5	0	6	11	0
E	Working with forms, records, reports, directives, or technical data	0	9	26	5	16	6	42	100
F	Performing laboratory and field tests	0	0	0	0	0	0	0	0
G	Constructing and maintaining rigid pavements and concrete structures	100	91	13	16	11	13	1	0
H	Constructing and maintaining flexible pavements	100	100	9	16	3	13	0	0
I	Constructing and maintaining drainage systems	80	61	9	16	5	25	0	0
J	Building bunkers and revetments	40	12	0	0	0	6	0	0
K	Constructing and maintaining pre-fabricated surface mats	0	0	0	5	3	6	3	0
L	Working with explosives	0	0	0	0	3	0	0	0
M	Constructing and maintaining railroad trackage	20	21	0	5	0	6	0	0
N	Performing grounds maintenance	80	36	26	53	100	81	9	0
O	Applying herbicides and fungicides	0	0	0	0	8	0	0	0
P	Operating trucks, front end loaders, and forklifts	80	73	26	47	24	19	38	0
Q	Operating industrial tractors and attachments	0	9	13	47	18	13	7	0
R	Operating graders	20	0	0	26	0	6	0	0
S	Operating dozers and scrapers	0	0	9	11	0	6	20	0
T	Operating specialized equipment	0	15	100	100	3	0	1	0
U	Operating cranes and attachments	20	3	9	42	0	0	0	0
V	Operating miscellaneous equipment	20	24	26	26	5	31	100	100
W	Performing snow removal functions	20	45	35	26	8	0	14	0
X	Rigging hoisting equipment	20	12	0	16	8	0	8	0
Y	Performing missile support functions	0	3	0	5	3	0	0	0
Z	Operating well drilling equipment	0	3	0	0	0	0	0	0

APPENDIX B: COMPARISON OF CIVILIAN AND MILITARY MEMBERS ON SIX VARIABLES BY JOB CLUSTER

Table B1. Comparison of Civilian and Military Members on Six Variables by Job Cluster

Job Cluster	Grp ID	N	Number of Tasks Performed			ATDPUTS			Job Difficulty			Months in Job			Job Interest			Job Utilization of Training and Talents		
			Mean	S.D.	t-test	Mean	S.D.	t-test	Mean	S.D.	t-test	Mean	S.D.	t-test	Mean	S.D.	t-test	Mean	S.D.	t-test
Supervisor/NCOIC (Grp 182)	Civ	114	88.14	36.13		5.33	0.22		16.66	2.74		100.63	94.64		6.03	0.93		5.37	1.33	
	Mil	217	67.41	32.98	5.256[a]	5.30	0.23	1.237	15.04	2.56	5.36[a]	20.99	33.76	11.134[a]	5.52	1.38	3.500[a]	4.55	1.61	4.681[a]
Controller, Pavements and	Civ	2	14.00	7.00		5.34	0.08		11.06	0.96		260.00	40.00		5.50	0.50		6.00	1.00	
Grounds (Grp 070)	Mil	26	12.54	7.95	0.251	5.01	0.21	2.167[c]	9.52	1.21	1.743	32.08	54.38	5.763[a]	3.88	1.99	1.136	3.08	1.81	2.230[c]
Controller, Vehicle	Civ	4	13.75	11.84		4.53	0.32		7.53	0.99		63.00	69.13		5.50	0.50		4.50	1.50	
(Grp 072)	Mil	32	18.53	10.39	0.856	4.73	0.40	0.960	8.80	2.06	1.20	24.71	29.05	2.092[c]	4.48	1.41	0.871	3.56	1.75	1.022
Pavements Maintenance	Civ	49	67.57	27.499		4.05	0.15		9.73	2.32		67.[illegible]	[illegible]		5.27	1.08		4.17	1.43	
Helper (Grp 390)	Mil	230	60.46	21.99	2.007[c]	4.05	0.17	0.077	9.23	2.02	1.571	27.53	23.11	6.305[a]	3.58	1.74	6.552[a]	2.76	1.38	6.550[a]
Pavements Maintenance	Civ	95	157.86	52.88		4.24	0.13		16.29	3.02		55.34	70.22		5.43	1.20		4.38	1.55	
Specialist (Grp 394)	Mil	342	146.44	56.77	1.760	4.29	0.16	2.812[b]	15.80	3.30	1.29[illegible]	37.20	35.42	3.455[a]	4.34	1.61	6.163[a]	3.27	1.42	6.629[a]
Asphalt Specialist	Civ	9	71.78	13.58		4.23	0.15		10.90	1.40		111.13	118.31		6.11	0.74		5.11	1.52	
(Grp 344)	Mil	18	54.39	11.32	3.523[b]	4.08	0.21	1.954	8.97	1.38	3.498[b]	13.72	9.40	4.050[a]	2.83	1.47	6.444[a]	2.18	1.34	5.130[a]
Pavements Maintenance Foreman/	Civ	36	396.72	145.35		4.81	0.13		21.52	1.98		100.09	89.66		6.00	[illegible]		5.28	1.35	
NCOIC (Grp 425)	Mil	76	310.24	229.83	2.068[c]	4.85	0.23	1.134	18.30	4.74	6.137[a]	46.01	53.52	4.012[a]	5.32	1.43	2.661[b]	4.08	1.64	3.816[a]
Concrete Specialist	Civ	4	27.25	3.96		4.07	0.15		6.72	0.59		100.75	99.54		6.25	0.83		4.50	1.50	
(Grp 542)	Mil	26	27.00	8.81	0.017	3.95	0.19	1.177	6.20	1.21	0.836	26.89	22.61	3.530[b]	3.08	1.71	3.610[b]	3.00	1.73	9.041[a]
Heavy Equipment Operator	Civ	314	196.63	81.96		4.91	0.24		20.05	3.13		117.63	99.55		5.87	1.[illegible]		[illegible]	1.42	
(Grp 415)	Mil	657	149.92	74.57	8.839[a]	4.81	0.21	6.970[a]	17.52	3.35	11.257[a]	30.99	33.78	20.033[a]	5.19	1.47	4.277[a]	3.96	1.62	7.991[a]
Special Equipment Operator	Civ	77	77.71	27.55		4.43	0.21		12.13	2.36		69.20	85.12		5.01	1.37		3.85	[illegible]57	
(Grp 248)	Mil	347	66.95	28.35	3.028[b]	4.45	0.23	0.587	11.41	2.30	2.017[c]	27.73	31.69	7.136[a]	4.34	1.63	3.389[a]	3.06	1.[illegible]	4.399[a]
Front End Loader Operator	Civ	7	29.29	13.83		4.69	0.19		9.52	1.62		95.00	86.94		6.29	0.45		4.43	0.90	
(Grp 199)	Mil	66	32.29	11.87	0.627	4.54	0.22	1.709	9.13	1.55	0.628	24.61	26.12	4.983[a]	4.20	1.83	2.984[b]	3.36	1.53	1,816
Vehicle Inspector	Civ	6	51.00	25.49		4.73	0.20		11.42	0.56		127.17	96.78		5.50	1.26		3.83	1.86	
(Grp 237)	Mil	7	37.86	10.37	1.255	4.73	0.19	0.046	10.02	4.81	0.704	32.86	23.56	2.510[c]	4.86	0.83	1.103	3.29	1.28	0.626
Grounds Maintenance Foreman	Civ	93	169.04	76.84		4.68	0.21		17.74	3.67		60.65	57.80		5.84	1.27		5.04	1.55	
(Grp 411)	Mil	28	116.04	58.51	2.793[b]	4.65	0.21	0.626	15.44	3.94	2.863[b]	43.71	65.31	1.319	5.07	1.67	2.592[c]	3.82	1.87	3.477[a]
Airfield Clearing/Grounds	Civ	261	116.87	42.97		4.23	0.15		13.87	3.00		49.55	54.94		5.28	1.21		4.26	1.47	
Maintenance Worker (Grp 558)	Mil	59	103.19	42.56	2.212[c]	4.24	0.16	0.318	13.00	2.95	2.026[c]	30.48	16.35	2.638[b]	4.02	1.57	6.849[a]	2.78	1.24	7.117[a]
Grounds Maintenance Worker/	Civ	235	52.57	17.12		4.08	0.20		8.77	1.84		56.93	62.45		5.38	1.18		4.39	1.59	
Industrial Tractor Opr. (Grp 589)	Mil	23	51.52	21.36	0.274	4.11	0.22	0.759	8.81	2.28	0.112	24.04	20.75	2.508[c]	3.44	2.00	6.981[a]	2.44	1.47	5.659[a]
Laborer/Gardner	Civ	267	22.06	11.63		3.79	0.30		5.20	1.78		47.45	69.37		4.94	1.31		3.65	1.75	
(Grp 187)	Mil	65	25.62	12.66	2.175[c]	3.87	0.29	1.921	5.81	1.85	2.487[c]	31.42	34.52	1.807	2.86	1.81	10.588[a]	2.21	1.12	6.352[a]
Industrial Tractor Operator/	Civ	24	24.58	11.38		4.12	0.13		6.73	1.14		23.33	48.17		4.30	1.55		2.88	1.[illegible]	
Grounds Maint. Worker (Grp 190)	Mil	2	21.00	3.00	0.436	4.27	0.19	1.531	7.08	1.07	0.422	76.00	68.00	1.456	4.50	0.50	0.175	2.50	0.50	0.287
Railroad Track Repairman/	Civ	17	56.12	22.21		4.10	0.27		9.10	2.37		63.88	76.48		4.41	1.54		2.82	1.54	
Grounds Maint. Worker (Grp 354)	Mil	8	55.13	15.73	0.113	4.07	0.28	0.231	8.93	2.08	0.171	72.50	74.62	0.265	4.41	1.54	1.046	2.63	2.12	0.267
Dump Truck Driver (Grp 048)	Civ	21	22.67	18.25		4.19	0.22		6.81	1.91		51.60	47.82		5.10	1.48		4.50	1.83	
	Mil	75	20.88	12.87	0.511	4.28	0.34	1.208	7.08	1.76	0.612	21.15	22.13	4.176[a]	3.70	1.69	3.434[a]	2.41	1.23	6.115[a]
Dozer and Grader	Civ	20	43.65	17.55		5.25	0.21		13.08	1.33		127.74	96.39		5.21	1.28		4.30	1.55	
Operator (Grp 039)	Mil	22	38.82	19.85	0.832	5.30	0.24	0.683	12.89	1.64	0.403	23.27	19.83	4.975[a]	5.18	1.40	0.069	3.82	1.34	1.081
Pavements Maintenance	Civ	5	29.20	15.75		3.93	0.23		6.27	1.44		45.75	63.70		3.80	2.04		2.25	1.64	
Laborers (Grp 064)	Mil	33	21.24	10.03	1.533	4.06	0.26	1.048	6.18	1.55	0.120	24.12	23.[illegible]	1.464	2.94	1.71	1.028	2.39	1.41	0.208
Airfield Sweeper (Grp 068)	Civ	23	13.61	7.81		4.51	0.21		7.46	0.98		120.23	106.[illegible]		5.44	0.97		4.30	1.52	
	Mil	19	18.37	12.01	1.548	4.49	0.26	0.305	7.76	1.36	0.831	20.47	21.34	4.025[a]	3.79	1.94	3.575[a]	2.72	1.28	3.604[a]
Litter Patrol/Grounds	Civ	38	6.42	4.85		4.05	0.69		5.62	2.30		45.84	71.35		4.41	1.48		3.22	1.84	
Maintenance Worker (Grp 021)	Mil	16	7.50	4.82	0.748	4.26	0.88	0.929	6.20	3.56	0.722	15.06	9.20	1.710	2.56	1.97	3.780[a]	1.94	1.56	2.440[c]
Truck Driver/Refuse	Civ	74	15.05	13.53		4.55	0.15		7.73	1.29		64.75	67.07		4.85	1.25		3.86	1.69	
Collector (Grp 649)	Mil	2	8.50	0.50	0.680	4.48	0.03	0.654	6.89	0.15	0.911	13.00	1.00	1.084	3.50	0.50	1.519	1.50	0.50	1.961[c]

[a] Significant at .001 level of confidence

[b] Significant at .01 level of confidence

[c] Significant at .05 level of confidence

APPENDIX C: PAVEMENTS MAINTENANCE AND CONSTRUCTION EQUIPMENT OPERATOR DATA COLLECTED IN 1969 – FIRST-TERM AIRMEN

Table C1. Pavements Maintenance and Construction Equipment Operator Data Collected in 1969 – First Term Airmen

Group	N	Percent Members Performing	Percent Time Spent
Comparison of Poorly and Well Utilized Groups on Duty N–Maintaining Vegetated Areas			
Poorly Utilized	407	77.4	21.1
Well Utilized	390	73.8	10.1
Group	**N**	**Mean**	**SD**
Average Number of Tasks Performed by the Poorly and Well Utilized Groups			
Poorly Utilized	407	36.02	26.84
Well Utilized	390	51.54	32.07
Group	**N**	**Percent Members Performing**	**Percent Time Spent**
Comparison of Three Job Types on Duty N–Maintaining Vegetated Areas			
Grounds Workers	125	99.2	42.1
Equipment Operators	282	7[illegible].6	7.7
Pavements Workers	243	87.2	10.8
Group	**N**	**Mean**	**SD**
Average Number of Tasks Performed for Three Job Types			
Grounds Workers	125	64.59	34.43
Equipment Operators	282	168.50	64.61
Pavements Workers	243	189.02	65.59
Average Job Difficulty Composite for Three Job Types			
Grounds Workers	125	7.94	2.18
Equipment Operators	282	13.95	3.14
Pavements Workers	243	16.03	3.93
Average Felt Utilization of Talents and Training for Three Job Types			
Grounds Workers	121	1.98	1.01
Equipment Operators	276	3.31	1.50
Pavements Workers	241	2.78	1.33

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